ARGUMENT

Request for Personal Interview:

A personal interview with the Examiner is respectfully requested. Applicants' representative will contact the Examiner to set a mutually convenient date and time.

Regarding the Claims in General:

Claims 1-13 remain pending without further change. Non-elected claims 14-23 have been canceled without prejudice to presentation in a divisional application.

Regarding the Prior Art Rejections:

Claims 1, 2, 12, and 13 stand rejected as being anticipated by Namerikawa U.S. Patent 6,523,423 (Namerikawa '423), and claims 1-4, 12 and 13 stand rejected as being anticipated by Namerikawa U.S. Patent 6,347,555 (Namerikawa '555). In addition, claims 1-5 and 8-13 stand rejected as being unpatentable over Sato U.S. Patent 5,985,064 (Sato) in view of either Namerikawa '423 or Namerikawa '555, and claims 1-7 and 12-13 stand rejected as being unpatentable over Mizutani Japanese Published Application JP 2000-369072 (Mizutani) in view of either Namerikawa '423 or Namerikawa '555). Applicants respectfully traverse these rejections.

Claim 1 is directed to an apparatus for aligning a bonding tool which comprises:

> a force sensor configured to measure a force generated by the bonding tool on the force sensor,
>
> wherein the force sensor comprises a plurality of force sensing sections, each sensing section being adapted to individually detect an amount of force from a part of the bonding tool acting on that sensing section,
>
> the apparatus being responsive to the relative values of the detected forces to generate an alignment signal for adjusting the orientation of the bonding tool.

None of the references, whether considered alone or in combination, disclose, teach or suggest an arrangement which meets, *or is capable of meeting*, the terms of claim 1.

As previously explained, the present invention is concerned with aligning a bonding tool designed to carry a semiconductor die so that the die is brought into contact with a surface to which it is to be bonded in substantially parallel relationship. As noted in the specification, alignment between the die and the contact surface must be within 16 microns. This is necessary to avoid cracking of the die, misplacement on the contact surface, and proper bonding.

Neither of the Namerikawa et al. patents discloses, teaches or suggests anything about alignment of a semiconductor chip bonding tool. However, the Examiner says that the devices disclosed in these patents are inherently capable of use for alignment of a bonding head. With all due respect, the Examiner is not correct.

Specifically, in Namerikawa '423, the amount of stress generated in a flexible plate is measured. The means of causing such stress is through movement of an operating member that is suspended on the flexible plate. This arrangement can inherently only measure displacement of the suspended operating member in the X, Y and Z axial directions (see col. 1, line 54 to col. 2, line 8).

While he has not explicitly said so, the Examiner is presumably envisioning that a bonding tool would be arranged to exert a force on the suspended operating member, which would bend the flexible plate, whereupon the stress resulting from such bending could be measured. Admittedly, Z-axis displacement of the operating member due to contact by a bonding head could be measured, but that would not be helpful.

With the '423 patent arrangement, the bond head could contact the surface of the operating member anywhere relative to the X, Y, Z coordinate system, and the stresses would be different for each location, independent of the bond head's vertical orientation. Conversely, for contact at the origin of the coordinate system, the operating member would not move at all, and thus no force would be detected, again, independent of the vertical orientation of the bond head.

To correct vertical misalignment, the arrangement of the '423 patent would have to be able to measure angular disorientation of the contact force relative to the Z-axis, which it obviously can not do.

Moreover, to correct vertical misalignment, there would also have to be a way to measure relative Z-axis displacement, but nothing like such a capability is disclosed, taught or suggested in the '423 patent.

The Namerikawa '555 patent teaches the same concept as Namerikawa '423. In fact, it further illustrates the difference between the approach of Namerikawa '423 and '555 from that of the present invention. The piezoelectric members for the X and Y axes are polarized to have opposite polarities to each other and the ones for the Z axis are polarized to all have equal polarities. Thus, when the operating member moves in the Z-axis direction, heteropolar electric charges generated in the piezoelectric elements for the X- and Y- axis directions offset each other so that no signal is output, and vice versa. "That is, in accordance with these sensor elements, <u>a component</u> for each axis of X, Y and Z can be detected without being influenced by physical quantities acting in any other axial directions" (col. 5, lines 44-62). As a result, only one absolute force component in the Z-axis direction may be measured, but the relative alignment of this force is irrelevant and is arguably even specifically excluded from consideration. Namerikawa '423 and '555 essentially describe the same device, which is incapable of operating according to the Examiner's suggestion.

It again should be emphasized that the sensor only measures stress in the plate and <u>not</u> the force of the bonding tool acting on each <u>force sensing portion</u> of the sensor. Any force is acting on the operating member and not on any of the force sensing sections. The Examiner seems to be ignoring this. Although the Examiner asserts that each section is "capable of individually detecting an amount of force from a part of a bonding tool acting on that sensing section", the teachings in Namerikawa '423 and '555 do not reveal this because they focus on (a) a force exerted by the suspended operating member acting on the flexible plate, and (b) measuring a stress generated by bending of the flexible plate, rather than the force acting on each sensing section.

For example, say only the left side of a bonding tool exerts a force on the operating member due to severe misalignment. The resultant bending of the flexible plate (assuming that the operating member is displaced) means that all sensors would experience a force, not just the sensor(s) corresponding to the left side of the bonding tool. Such a characteristic does not read on claim 1.

Sato is concerned only with controlling the downward movement of the bonding tool to apply a precise bonding force between a chip or die to be bonded and the bonding surface (see col. 1, lines 43-49). It does teach measuring a bonding force, but there is no disclosure, teaching, or suggestion in Sato of alignment of the bonding tool so that a chip contacts a bonding surface in precisely parallel relationship.

Mizutani, on the other hand, teaches controlling a height of a chip holder 27 to ensure that a chip 26 is placed precisely on a "diamond touch side 22a" of a package body 22. The focus is not on aligning the bonding tool as such, but on height calibration (see paragraphs [0022] and [0024]). Accordingly, there is no teaching to re-align either the chip holder 27 or the chip 26. Since flatness of a chip may vary, the approach is to relate the amount of movement of the conveying tool to the time when a load is detected by the load cell 25. It is not relevant to this invention as it is purely concerned with vertical movement by the chip holder 27.

Thus, if the amount of protrusion is S, the adjusting device is controlled to move the chip holder 27 by an additional gap height after a load is detected by the load cell 25 when the chip 26 first touches the package body 22 (see paragraph [0026] and Drawing 6). At no time does the chip holder 27 actually touch the package body 22 (not to mention the load cell 250 as it is pinching the sides of the semiconductor chip (see paragraph [0003]). This publication has nothing to do with alignment of a bonding tool at all, but only to height calibration.

Since none of the references are concerned with vertical alignment of a bonding head, and do not disclose, teach or suggest any structure capable of doing this, combining the references does not remedy the deficiencies in them separately. The rejections of claims 1-13 are therefore not well founded, and should be withdrawn.

In view of the foregoing, favorable reconsideration and allowance of this application are respectfully solicited.

I hereby certify that this correspondence is being transmitted by Facsimile to (571) 273-8300 addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date indicated below.

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October 27, 2005
Date of Signature

LAH:lac

Respectfully submitted,

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